

Ingested foreign bodies in children: BC Children's Hospital emergency room protocol

Clinicians should be aware of the dangers presented by disc batteries and other hazardous objects that may become lodged in the esophagus and require removal by rigid endoscopy.

ABSTRACT: In children, ingested foreign bodies are more common than aspirated foreign bodies. Most objects traverse the gastrointestinal tract without difficulty, but some sharp, large, or toxic objects may require removal by esophagoscopy or laparotomy. Foreign bodies in the esophagus can produce various symptoms, including dysphagia, drooling, and occasionally airway obstruction. Gastrointestinal foreign bodies produce less specific symptoms, including abdominal pain, melena, and hematochezia. All children with a history of foreign body ingestion should be evaluated with radiographs of the neck, chest, and abdomen. Radiolucent objects require direct visualization or contrast radiographs. Treatment will depend on the nature of the object, where it lodges, and how the body reacts. Observation might be sufficient or urgent removal might be required. Disc batteries in the esophagus must be removed urgently. Vigilant follow-up is required if nickel-containing coins appear to be causing systemic contact dermatitis or if a magnet has been ingested with another magnet or a metal object.

Foreign body ingestions occur more frequently than foreign body aspirations in children. Most ingested objects pass through the gut spontaneously. Occasionally, sharp or large objects lodge in the narrow parts of the gastrointestinal (GI) tract, commonly the esophagus, necessitating endoscopic removal. In contrast to adults who ingest and impact mostly organic objects, children tend to ingest inorganic objects.¹

In 2007, the divisions of emergency medicine and otolaryngology at BC Children's Hospital (BCCH) treated two patients who had an esophageal coin lodged for longer than one week prior to radiographic diagnosis, and two patients who had an esophageal disc battery that had originally been misdiagnosed as a coin. One of these patients developed a tracheocutaneous fistula (TEF) from erosion by a coin that had been lodged in the esophagus for several months. Fortunately, the TEF closed spontaneously after several days of intubation. All patients seem to have recovered fully, but they are still being monitored for signs of esophageal stenosis. In order to reduce the morbidity associated with delayed diag-

nosis in such cases and to establish a standard in the workup and management of children with ingested foreign bodies, we have developed the following guidelines.^{2,3}

Ingested objects and lodgment sites

Children usually swallow smooth rounded objects rather than sharp objects. Coins make up the majority of ingested objects in children (**Table**). Inert rounded objects pass more easily through the GI tract than sharp objects. However, one must be mindful of the fact that while disc batteries are rounded they are also very corrosive to the esophagus.⁴

The narrowest area within the GI tract is the esophagus, making this the

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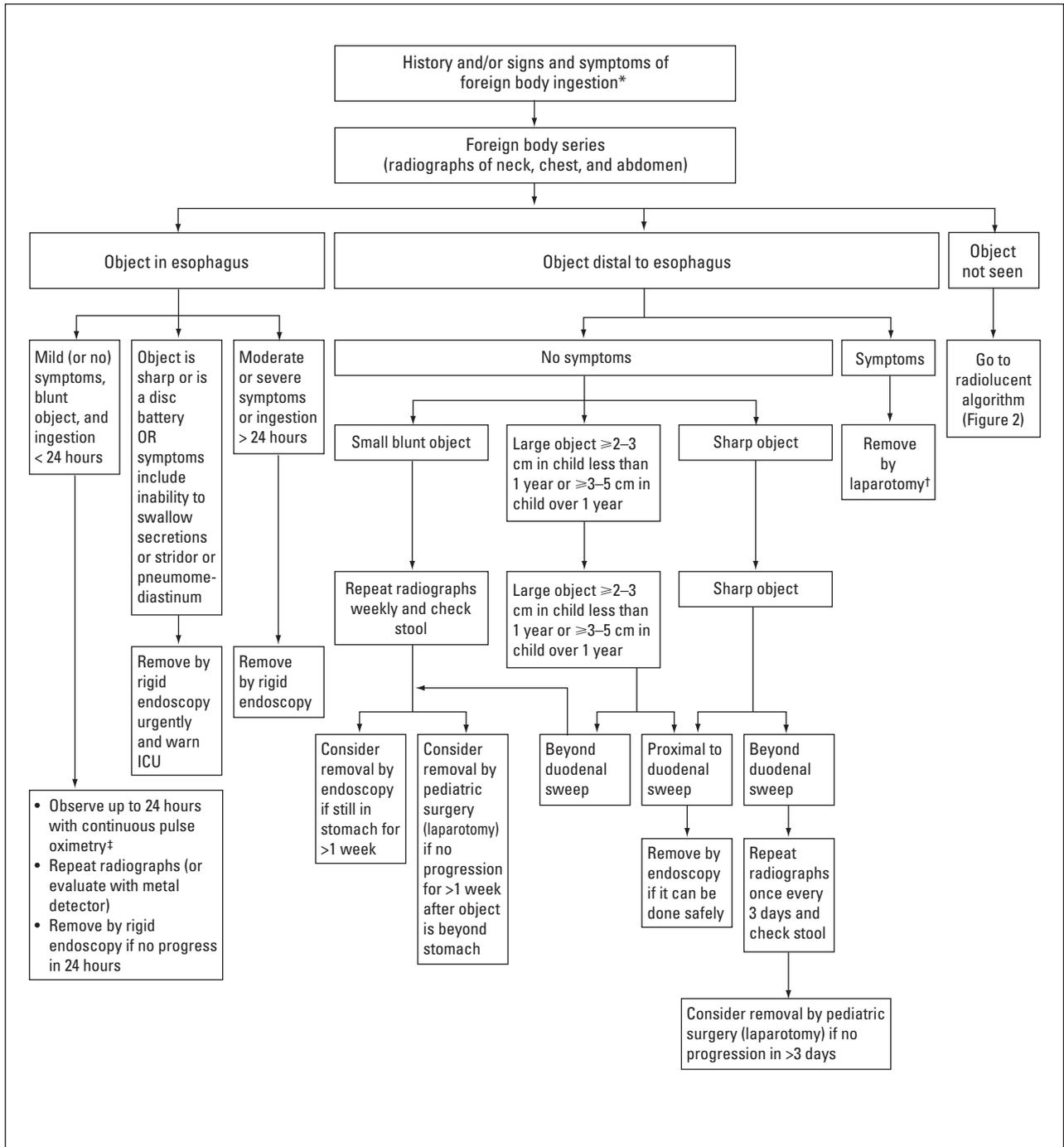


Figure 1. Treatment algorithm for suspected foreign body ingestions in a clinically stable child.

*Mild symptoms include refusal to eat, cough, nausea/vomiting, sore throat, and foreign body sensation. Moderate or severe symptoms include dysphagia, odynophagia, drooling, stridor, and retrosternal pain. Symptoms distal to the esophagus include hematochezia, melena, abdominal pain, and distension. Systemic symptoms include contact dermatitis to nickel.

†Endoscopy should be performed by a pediatric otolaryngologist or pediatric surgeon. Laparotomy should be performed by pediatric surgeon.

‡Continuous pulse oximetry is required in case of a "pop-up" of the foreign body into larynx.

Adapted from Uyemura MC. Foreign Body Ingestion in Children.³

commonest site of foreign body impaction. An esophageal foreign body may lodge in the thoracic inlet, the aortic arch area, or the gastroesophageal (GE) junction. The commonest site of impaction is the thoracic inlet followed by the GE junction and then the aortic arch.

Once the object passes into the stomach, the chance of lodgment and

impaction is very small. Rarely, sharp or large objects lodge in the pylorus, duodenum, cecum, appendix, rectum, or a location of congenital or acquired narrowing within the GI tract.⁵

Pathophysiology

Pathophysiological considerations for ingested foreign bodies include the anatomy of the lodgment site, the

physical properties of the foreign body (size, shape, and composition), and the body's reaction to the foreign body. For example, a disc battery may lodge in the narrowest part of the esophagus (the thoracic inlet), erode the esophageal wall, and cause tracheal edema, esophageal perforation, mediastinitis, and tracheoesophageal fistulization.

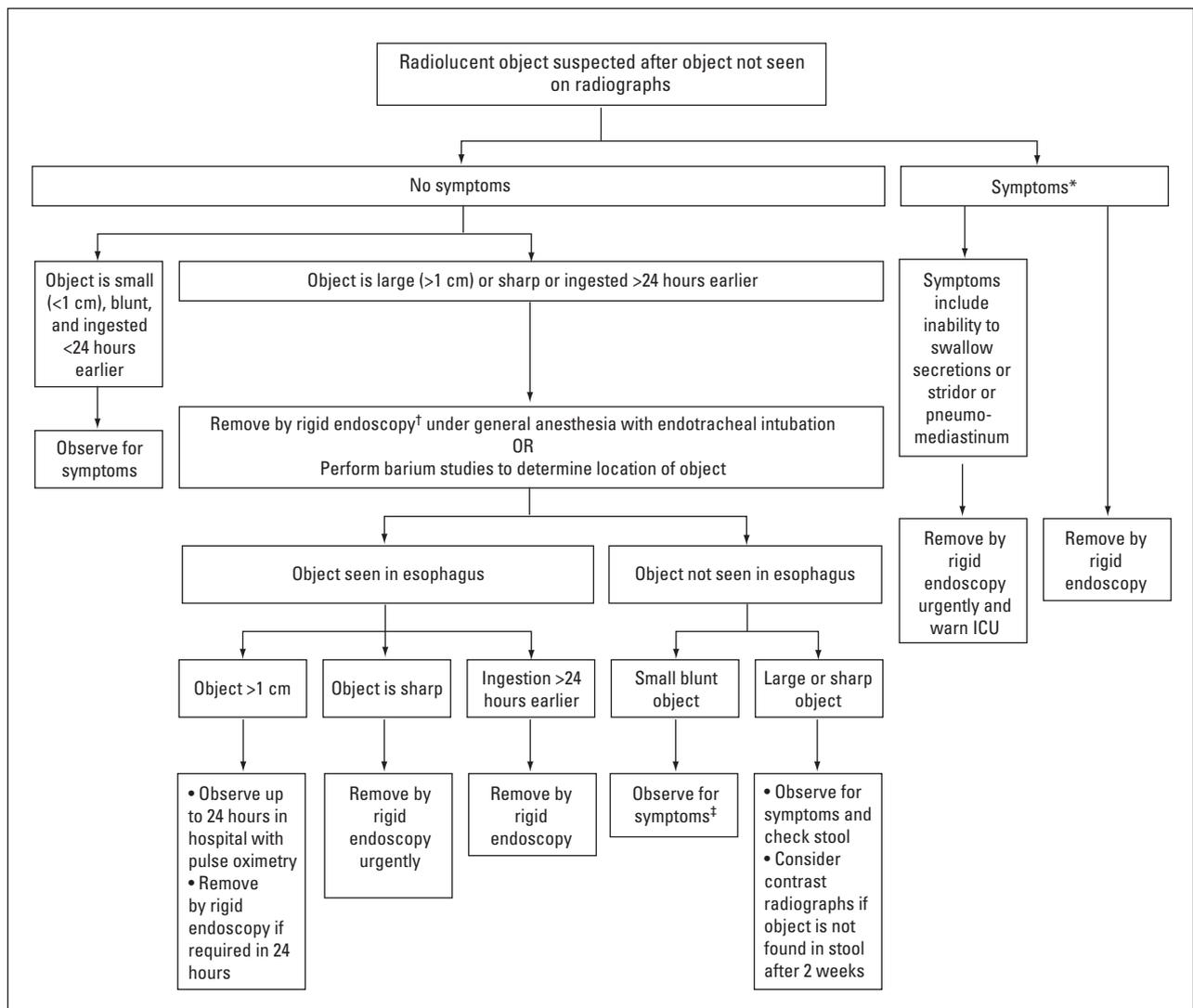


Figure 2. Treatment algorithm for suspected ingestion of a radiolucent object in a clinically stable child.

*Dysphagia, odynophagia, drooling, refusal to eat, foreign body sensation, nausea/vomiting, sore throat, cough, or retrosternal pain.

†Endoscopy should be performed by a pediatric otolaryngologist or pediatric surgery. Laparotomy should be performed by pediatric surgery.

‡Hematochezia, melena, abdominal pain, or distension

Adapted from Uyemura MC. Foreign Body Ingestion in Children.³

Table. Most common esophageal foreign bodies.

- Coins
- Disc batteries
- Buttons
- Rings
- Locketts
- Hairclips
- Meat chunks

Evaluation

Esophageal foreign bodies can make a child refuse to eat and can produce symptoms of dysphagia, drooling, coughing, stridor, vomiting, gagging, and regurgitation. Older children may be able to indicate they have a foreign body sensation in a specific location. However, many children with esophageal foreign bodies are asymptomatic. Distal foreign bodies produce less specific symptoms, ranging from abdominal pain to vomiting, distension, altered bowel movements, melena, and hematochezia.

The radiographic investigation used at BCCH is a "foreign body series," which includes a soft tissue lateral neck radiograph and a "wide" chest radiograph of the oropharynx, chest, and abdomen. Classically, esophageal foreign bodies that are thin and round (such as coins) are oriented coronally. Lateral radiographs are sometimes used to rule out multiple coins or help differentiate disc batteries from coins.

In addition, handheld metal detectors are sometimes used to monitor the progression of a metallic foreign body as it passes through the GI tract. The advantage, of course, is less radiation exposure for the child.

Diagnosis of radiolucent foreign bodies, such as wooden, plastic, and glass objects, requires endoscopic evaluation or contrast radiography.

Treatment

Treatment for objects visible on a radiograph (see **Figure 1**) and not visible (see **Figure 2**) can involve endoscopy. Rigid endoscopic removal under general anesthesia with oral endotracheal intubation is the commonest way to retrieve esophageal foreign bodies. There is no evidence that medications such as glucagon help the distal passage of esophageal foreign bodies in children.⁶

Most esophageal coins do not require removal late at night. In the absence of severe pain, airway symptoms, or suspicion of a disc battery, the anesthetic and surgical risks of removal late at night are usually considered to be greater than the risks of overnight observation. Depending on size, there is usually a reasonable possibility that the coin will fall into the stomach while a child sleeps. Because of the extremely small risk that an esophageal coin will "pop up" into the larynx, continuous pulse oximetry is recommended during observation.

For foreign bodies distal to the esophagus, surgical removal by laparotomy is required only in rare cases where a foreign body cannot be retrieved endoscopically, when a complication such as perforation or obstruction has arisen, or in exceptional cases where sharp or large objects do not demonstrate transit progression for weeks.⁷

Rare complications of esophageal foreign bodies include esophageal perforation, mediastinitis, tracheoesophageal fistula formation, pneumomediastinum, and airway obstruction. Complications of distal bowel impaction are much less common and include rupture of hollow viscera and hemorrhage, peritonitis, bowel obstruction, abscess formation, and inflammatory tumors.⁸

Special circumstances

Large esophageal foreign bodies such as marbles can impinge on the airway and cause stridor (typically biphasic). These foreign bodies require urgent removal. Sharp esophageal foreign bodies, such as needles, pins, and hairclips can perforate the esophagus and lead to pneumomediastinum, and must also be removed urgently. Rarely, esophageal foreign bodies, especially coins, become sagittally oriented and can encroach on the trachea, causing biphasic stridor and requiring urgent removal. The presence of pneumomediastinum in the context of an esophageal foreign body suggests esophageal perforation and is another indication for urgent removal of the foreign body.

Disc battery ingestions have traditionally been feared as they can cause corrosive injury. A disc battery is removed endoscopically on an urgent basis if it is found to be in the esophagus. At BCCH, the removal of an esophageal disc battery belongs to a Class I category of urgency (removal scheduled even if the stomach is full). When a round metallic object is noted radiographically in the esophagus, the clinician must ask parents or caregivers about the possibility of exposure to disc batteries and must look for signs of a disc battery on the radiograph. It is imperative to differentiate between coins and disc batteries when evaluating the radiograph of a foreign body. Disc batteries, like coins, are usually oriented coronally in the esophagus. Subtle radiographic signs of most (but not all) disc batteries include a double contour on the anterior-posterior view (**Figure 3**) and shouldering on the lateral view (**Figure 4**). Recent studies suggest that once a disc battery moves past the esophagus that systemic absorption is rare. No treatment is therefore required if a disc battery has reached the stomach.

Rarely, children present with a systemic contact dermatitis secondary to sensitivity to nickel liberated from ingested coins. The commonest site of the ingested foreign body in such cases is the stomach as it is the exposure to an acidic environment that leads to a high level of nickel systemically. Treatment with a strong laxative to encourage transit can be attempted. Failing this, endoscopic removal is recommended.

Ingestion of magnets causes no systemic toxicity. However, if more than one magnet is ingested, or if a magnet is swallowed with a piece of metal, then there is a higher risk of complications due to impaction of bowel between the attracting objects. Reported complications include perforation, volvulus, ulceration, and peritonitis. These patients therefore require a more vigilant follow-up.⁹

Clinicians should also be alert to the complication associated with two attracting magnets on either side of the nasal septum. This situation can permanently damage the septum and requires an urgent consult with an otolaryngologist, usually followed by general anesthesia for removal.

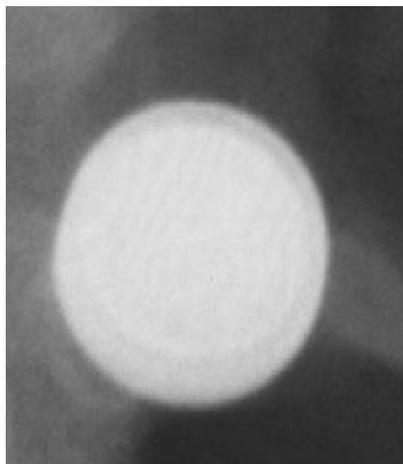


Figure 3. Note the double contour appearance of a disc battery on a foreign body radiograph.

Stable children suspected of foreign body ingestion are all candidates for the treatment described here. However, these treatments should not be considered for:

- Secondary airway compromise from upper GI impaction necessitating immediate removal of the ingested object.
- Clinically unstable children with decreased level of consciousness, airway compromise, respiratory failure (abnormalities of oxygenation and ventilation), and/or shock.

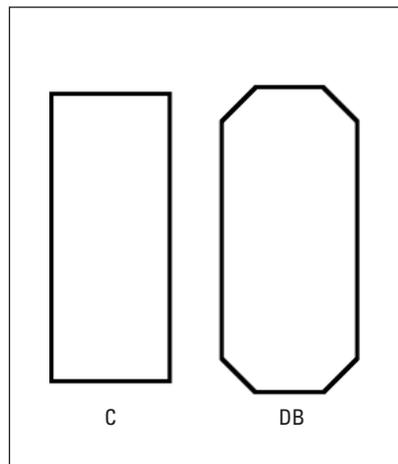


Figure 4. Note the lateral appearance of a coin (C) versus that of a disc battery (DB) in this schematic presentation.

Endoscopic removal under general anesthesia should be considered if symptoms are moderate or severe, if the foreign body is sharp or long, or if there is no progress within 24 hours.

Summary

All children with a history of foreign body ingestion should undergo radiographic evaluation. Radiolucent objects will require direct visualization or contrast radiographs for location specification.

Relatively asymptomatic patients with ingested foreign bodies may require up to 24 hours of observation in a hospital with continuous pulse oximetry. Endoscopic removal under general anesthesia should be considered if symptoms are moderate or severe, if the foreign body is sharp or long, or if there is no progress within 24 hours. Disc batteries must be removed urgently.

Once foreign bodies travel beyond the esophagus, most traverse the GI tract without complications. Long or sharp objects proximal to the duodenal sweep are sometimes removed endoscopically, if possible. Long and sharp objects beyond the duodenal sweep require radiographic follow-up to ensure transit. If no progression is noted for weeks, then removal by general surgery should be considered. If complications such as perforation ensue, then laparotomy should be performed by general surgery.

If more than one magnet is ingested, or if a magnet is swallowed with a piece of metal, then there is a higher risk of complications due to impaction of bowel between the attracting objects.

If systemic dermatitis to nickel liberated from coins occurs, endoscopic removal should be considered. If a magnet is ingested with another magnet or a metal object, more vigilant follow-up will be required.

Dedication

Dr Ludemann dedicates this work to the memory of Dr Michael F. Smith, esteemed anesthesia colleague and friend.

Competing interests

None declared.

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